FIBER-SPAN
RF ON FIBER® Technology

FS3100 SERIES Fiber Optic RF Repeater

Theory of Operation

System level operation

The primary application for this transmission system is to function as a fiber optic antenna repeater. The system consist of a Fiber Transceiver Unit (FTU) and a Optical Repeater Unit (ORU). The system is a bi-directional featuring a duplexed port for coaxial cable type Distributed Antenna Systems and separate uplink and downlink ports for compatibility with a Fiber Optics System. RF signals originating from the Fiber Transceiver Unit transmitter input will be referred to as downlink signals. RF signals provided to the (ORU) Optical Repeater Unit receiver output will be referred to as uplink signals. This system has been optimized to transport downlink frequencies between 851-869 MHz and uplink frequencies between 806-824 MHz.

The FS31LM-01-LMC (FTU) system has been optimally designed to provide remote antenna coverage from one to many stations into one or more remote locations. A system block diagram is attached 7109-0712. There are not any oscillators or frequency determining components in this system and there is not any tune up or alignment required. The system is configured to allow radio communications between one or more remote sites to the appropriate Fiber Transceiver Unit. The FS31LM-01-LMC (FTU) is a standard 1u, 19” sub-rack that interfaces to FS31HM-85-C-18-65 (ORU). Two fibers connect to the units. Each fiber carries separately the uplink and the downlink signals. The remote modules are rugged IP65 enclosures. All units are powered using an external AC power wall plug.

Downlink RF signals provided to the Fiber Transceiver Unit sub-rack are converted to intensity modulated lightwave signals via a Fiber-Span FS310 fiber optic transceiver (transmitter section). The downlink light is transported to the remote module via the downlink fiber. Light received from the downlink fiber into the FS31HM-85-C-18-65 is connected to the optical receiver side of a Fiber-Span FS311 fiber optic transceiver (receiver section). The FS311 receiver section converts the optical intensity modulated light into RF and provides some RF amplification. The recovered downlink RF is then amplified by the power amplifier (PA). The PA output is then passed through a Diplexer to isolate the frequency band 851-869 Mhz. The Diplexer output is connected to the antenna port on the remote module enclosure. The output RF power is optimized for 1 Watt (31 dBm). When the rf power output has reach 31 dBm the automatic level circuit will activate and the output level will stay constant at 31 dBm while the rf input power keeps increasing. Integrated in the Power Amplifier (PA) is a feedback circuitry to control the output power.

Uplink RF signals collected by the Optical Repeater Unit antenna are passed to a Diplexer. The Diplexer uplink signals (806-824 Mhz) are amplified with a low noise amplifier (LNA). The LNA output is connected to the FS311 fiber optic transceiver (transmitter section) RF input. The FS311 converts the uplink RF into an intensity modulated optical uplink signal. Light output from the FS311 is transported to the FS31LM-01-LMC sub-rack via the uplink fiber. The uplink optical signal is provided to a FS310 fiber optic receiver inside the sub-rack. Uplink light is converted to uplink RF by the FS310. The uplink RF connects to the appropriate Fiber Transceiver Unit. The uplink noise figure is typically 4 dB.

The Uplink rf gain can be adjusted via a potentiometer. The rf gain setting is adjusted to accommodate any fiber optical loss. RF signal connections can than be distributed to the desired base station unit.

Component level operation
The significant components in this system are:

FS310	Fiber Optic Transceiver
FS311	Fiber Optic Transceiver
MA836/2.3/430K-A	Low Noise Amplifier
MA836/5/430K-B	Power Amplifier
CD838/18SK-G1	Diplexer

The FS310 transmit section and the receive section of the FS311 form the downlink RF fiber optic link. Connected together yields an RF performance as:

RF Gain	Noise Figure	Input IP3
-8 dB	38 dB	31 dBm

The transmit section of the FS311 and the FS310 receive section form the uplink RF fiber optic link. Connected together yields an RF performance as:

RF Gain	Noise Figure	Input IP3
-17 dB	44 dB	30 dBm

The LNA provides a gain of 42 dB with a noise figure of 4 dB and an input IP3 of –8 dBm. The LNA utilizes industry standard MMIC broadband gain blocks.

The MSI PA provides a rf gain of 45 dB with a noise figure of 8 dB and an input IP3 of 5 dBm. The PA utilizes industry standard practices for RF power amplifiers. The amp has integrated Automatic Level Control (ALC) which monitors output power for constant level.

The Diplexer specification is attached.